

Claims

1. A setting tool comprising a head piece, in particular for holding a rivet, a device for gripping and/or pulling and a pulling apparatus connected to the device for gripping and/or pulling, which comprises:
- means for measuring the variable values occurring during the setting operation;
 - a device for comparing the measured values with stored values;
 - a device for determining a cause, in particular a cause of a fault, for the deviation of measured values from stored values from a set of stored causes.
2. The setting tool as claimed in claim 1, wherein the variable values comprise the tension exerted by the pulling apparatus and/or the position of the pulling apparatus and/or the time since the start of the respective setting operation and/or the angle with respect to the surface on which the setting implement is placed.
3. The setting tool as claimed in claim 1 or 2, which comprises the stored causes of faults:
- implement not placed at the correct angle; and/or
 - wrong rivet used; and/or
 - rivet damaged; and/or
 - hole provided for the rivet too wide or too narrow; and/or
 - no rivet in the setting tool; and/or
 - rivet not gripping both parts to be connected;

and/or

- setting tool has a defect.

4. The setting tool as claimed in claim 1, 2 or 3, wherein
5 the device for measuring the tension exerted by the
pulling apparatus comprises a strain gage.
5. The setting tool as claimed in claim 1, 2 or 3, wherein
10 the device for measuring the tension exerted by the
pulling apparatus comprises a piezoelectric sensor.
6. The setting tool as claimed in one of the preceding
claims, wherein a capacitive sensor is provided for
measuring the position of the pulling apparatus.
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7. The setting tool as claimed in one of the preceding
claims, wherein the angle can be measured by means of at
least three sensors arranged on the implement head.
- 20 8. The setting tool as claimed in one of the preceding
claims, wherein the setting tool comprises means for
data storage and/or further processing.
9. The setting tool as claimed in one of the preceding
25 claims, wherein the means for data storage and further
processing can be reset, in particular during an
implement service.
10. The setting tool as claimed in one of the preceding
30 claims, wherein a chip is provided for the comparison of
measured and stored values and/or for the data storage
and further processing.

11. The setting tool as claimed in one of the preceding claims, wherein the comparison of measured and stored values and/or the data storage and further processing are carried out in the implement.
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12. The setting tool as claimed in one of the preceding claims, wherein an independent power source, in particular a rechargeable battery, is provided in the implement for the means for comparing measured and
10 stored values and/or for the data storage and further processing.
13. The setting tool as claimed in one of the preceding claims, wherein the setting implement comprises a
15 counter which counts rivet setting cycles and/or faults and/or causes of faults.
14. The setting tool as claimed in one of the preceding claims, wherein the setting implement comprises a device
20 for registering the date and/or time of day.
15. The setting tool as claimed in one of the preceding claims, which comprises a device for transmitting measured values to an external unit.
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16. The setting tool as claimed in claim 15, the device for transmitting measured values comprising a device for transmitting infrared, ultrasound or radio signals, in particular "Bluetooth".
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17. The setting tool as claimed in claim 15, wherein the data transmission is carried out by means of an optical conductor.

18. The setting tool as claimed in claim 15, 16 or 17, the external unit comprising a computing unit.
- 5 19. The setting tool as claimed in claim 15, 16, 17 or 18, the external unit comprising a mobile radio terminal.
- 10 20. The setting tool as claimed in one of claims 1 to 19, which further comprises a device for switching off the rivet setting implement and/or indicating the cause of a fault in response to a signal generated in the event of a faulty rivet setting operation.
- 15 21. The setting tool as claimed in claim 20, the signal being generated by an external unit.
- 20 22. The setting tool as claimed in one of claims 1 to 21, which comprises a device for connection to a local network.
- 25 23. The setting tool as claimed in one of claims 1 to 23, the pulling apparatus comprising a draw spindle and the device for gripping a rivet pin comprising clamping jaws for clamping a rivet pin.
- 30 24. The setting tool as claimed in one of the preceding claims, wherein the pulling apparatus is operated electrically, in particular with a rechargeable battery, electrohydraulically, hydraulically or hydropneumatically.
25. The setting tool as claimed in claim 24, wherein a line for the supply of compressed air or power and at least

one further line for the transmission of the measured values can be connected to the setting implement, and the further line, together with the one line, forms one strand with one connection.

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26. The setting tool as claimed in one of claims 1 to 24, wherein the implement can be operated by means of an internal power source, in particular a rechargeable battery.

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27. The setting tool as claimed in one of the preceding claims, wherein the tool has a device for carrying out a test cycle after being switched on.

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28. A method for monitoring setting operations, in particular rivet setting operations, comprising the steps:

- inserting a part to be set into a setting implement, preferably a setting implement as claimed in the preceding claims;
- applying a tensile force to the part to be set by means of a pulling apparatus;

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which comprises the steps

- measuring the variable values which occur;
- comparing the measured values with stored values;
- determining a cause, in particular a cause of a fault, for the deviation of measured from stored values from a set of stored causes.

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29. The method as claimed in claim 28, wherein the variable value measured is the tension exerted by the pulling apparatus and/or the position of the pulling apparatus and/or the time since the start of the respective

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setting operation and/or the angle with respect to the surface on which the setting implement is placed.

- 5 30. The method for monitoring setting operations as claimed in claim 28 or 29, which further comprises the determination of the stored causes of faults:
- implement not placed at the correct angle; and/or
 - wrong rivet used; and/or
 - rivet damaged; and/or
 - 10 - hole provided for the rivet too wide or too narrow; and/or
 - no rivet in the implement; and/or
 - rivet not gripping both parts to be connected; and/or
 - 15 - setting tool has a defect.
- 20 31. The method for monitoring setting operations as claimed in claim 28, 29 or 30, wherein the tension exerted by the pulling apparatus is measured by means of a strain gage.
- 25 32. The method for monitoring setting operations as claimed in claim 28, 29 or 30, wherein the tension exerted by the pulling apparatus is measured by means of a piezoelectric sensor.
- 30 33. The method for monitoring setting operations as claimed in one of the preceding claims, wherein the position of the pulling apparatus is measured by means of a capacitive sensor.
34. The method for monitoring setting operations as claimed in one of the preceding claims, wherein rivet setting

cycles and/or faults and/or causes of faults are counted.

- 5 35. The method for monitoring setting operations as claimed in one of the preceding claims, wherein the date and/or time of day are measured.
- 10 36. The method for monitoring setting operations as claimed in one of the preceding claims, wherein the measured values and/or faults and/or causes of faults are passed on to an external unit.
- 15 37. The method for monitoring setting operations as claimed in one of the preceding claims, wherein, in the event of a faulty setting operation, the cause of a fault is indicated and/or the setting implement is switched off in response to a generated signal.
- 20 38. A head piece for a setting tool, especially for a setting tool as claimed in claims 1-27, which comprises:
- means for measuring the variable values occurring during the setting operation;
 - a device for comparing the measured values with stored values;
 - 25 - a device for determining a cause, in particular a cause of a fault, for the deviation of measuring values from stored values from a set of stored causes.
- 30 39. The head piece for a setting tool as claimed in claim 38, wherein the variable values comprise the tension exerted by the pulling apparatus and/or the position of the pulling apparatus and/or the time since the start of

the respective setting operation and/or the angle with respect to the surface on which the setting implement is placed.

- 5 40. The head piece for a setting tool as claimed in claim 38 or 39, which comprises the stored causes of faults:
- implement not placed at the correct angle; and/or
 - wrong rivet used; and/or
 - rivet damaged; and/or
 - 10 - hole provided for the rivet too wide or too narrow; and/or
 - no rivet in the implement; and/or
 - rivet not gripping both parts to be connected; and/or
 - 15 - setting tool has a defect.
41. The head piece for a setting tool as claimed in claim 38, 39 or 40, wherein a device, which comprises a strain gage, is provided for measuring the tension exerted by
- 20 the pulling apparatus.
42. The head piece for a setting tool as claimed in claims 38, 39 or 40, wherein a device, which comprises a piezoelectric sensor, is provided for measuring the
- 25 tension exerted by the pulling apparatus.
43. The head piece for a setting tool as claimed in one of the preceding claims 38-42, wherein a capacitive sensor is provided for measuring the position of the pulling
- 30 apparatus.
44. The head piece for a setting tool as claimed in one of the preceding claims 38-43, wherein the angle can be

measured by means of at least three sensors arranged on the front side.

- 5 45. The head piece for a setting tool as claimed in one of the preceding claims 38-44, wherein the setting tool comprises means for data storage and/or further processing.
- 10 46. The head piece for a setting tool as claimed in one of the preceding claims 38-45, wherein the means for data storage and further processing can be reset, in particular during an implement service.
- 15 47. The head piece for a setting tool as claimed in one of the preceding claims 38-46, wherein a chip is provided for the comparison of measured and stored values and/or for the data storage and further processing.
- 20 48. The head piece for a setting tool as claimed in one of the preceding claims 38-47, wherein the comparison of measured and stored values and/or the data storage and further processing are carried out in the head piece.
- 25 49. The head piece for a setting tool as claimed in one of the preceding claims 38-48, wherein an independent power source, in particular a rechargeable battery, is provided in the head piece for the means for comparing measured and stored values and/or for the data storage and further processing.
- 30 50. The head piece for a setting tool as claimed in one of the preceding claims 38-49, wherein the head piece comprises a counter which counts rivet setting cycles

and/or faults and/or causes of faults.

51. The head piece for a setting tool as claimed in one of the preceding claims 38-50, wherein the head piece
5 comprises a device for registering the date and/or time of day.
52. The head piece for a setting tool as claimed in one of claims 38 to 51, which comprises a device for
10 transmitting measured values to an external unit.
53. The head piece for a setting tool as claimed in claim 52, the device for transmitting measured values comprising a device for transmitting infrared,
15 ultrasound or radio signals, in particular "Bluetooth".
54. The head piece for a setting tool as claimed in claim 52, wherein the data transmission is carried out by means of an optical conductor.
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55. The head piece for a setting tool as claimed in one of claims 52 to 54, the external unit comprising a computing unit.
- 25 56. The head piece for a setting tool as claimed in one of claims 52 to 55, the external unit comprising a mobile radio terminal.
- 30 57. The head piece for a setting tool as claimed in one of claims 38 to 56, which further comprises a device for switching off the rivet setting implement and/or indicating the cause of a fault in response to a signal generated in the event of a faulty rivet setting

operation.

58. The head piece for a setting tool as claimed in claim 57, the signal being generated by an external unit.
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59. The head piece for a setting tool as claimed in one of claims 38 to 58, which comprises a device for connection to a local network.
- 10 60. A setting tool, in particular a rivet setting tool, comprising
- a head piece, in particular for holding a rivet,
 - a device for gripping and/or pulling a rivet pin, in particular, and
 - 15 - a pulling apparatus connected to the device for gripping and/or pulling a rivet pin, in particular, which comprises
 - a device comprising at least one piezoelectric sensor for measuring the tension exerted by the
 - 20 pulling apparatus.
61. The setting tool as claimed in claim 60, which comprises a device for measuring the position of the pulling apparatus.
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62. The setting tool as claimed in claim 60 or 61, wherein the device for measuring the tension exerted by the pulling apparatus comprises a pressure sensor.
- 30 63. The setting tool as claimed in claim 62, wherein the pressure sensor is a piezoelectric pressure sensor.
64. The setting tool as claimed in one of claims 60 to 63,

wherein the pulling apparatus is operated electrically, in particular with a rechargeable battery, electrohydraulically, hydraulically or hydropneumatically.

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65. The setting tool as claimed in one of claims 60 to 64, which comprises a device for registering and evaluating tension measured values.

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66. The setting tool as claimed in claim 65, wherein the device for registering and evaluating tension measured values comprises a counter which counts rivet setting cycles.

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67. The setting tool as claimed in claim 65, wherein the device for registering and evaluating tension measured values comprises a device for registering the date and/or time of day.

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68. The setting tool as claimed in one of claims 60 to 67, which comprises a device for transmitting tension measured data to an external unit.

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69. The setting tool as claimed in claim 68, the device for transmitting tension measured data comprising a device for transmitting infrared, ultrasound or radio signals.

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70. The setting tool as claimed in claim 68 or 69, the external unit comprising a computing unit.

71. The setting tool as claimed in claim 68, 69 or 70, the external unit comprising a mobile radio terminal.

72. The setting tool as claimed in one of claims 60 to 71, which further comprises a device for switching off the rivet setting implement in response to a signal generated in the event of a faulty rivet setting operation.
73. The setting tool as claimed in claim 72, the signal being generated by an external unit.
74. The setting tool as claimed in one of claims 60 to 73, which comprises a device for connection to a local network.
75. The setting tool as claimed in one of claims 60 to 74, the pulling apparatus comprising a draw spindle and the device for gripping a rivet pin comprising clamping jaws for clamping a rivet pin.
76. The setting tool as claimed in one of claims 60 to 75, which is a rivet setting tool.
77. A method for monitoring setting operations, in particular rivet setting operations, in particular rivet setting operations performed with a setting implement, preferably a rivet setting implement as claimed in one of the preceding claims, comprising the steps of
- inserting the part to be set, in particular a rivet, into an opening and
 - applying a tensile force to the part to be set, in particular the rivet pin,
- by means of a pulling apparatus, wherein, during the application of the tensile force, at least one measured value is obtained which is caused or

influenced by the tensile force applied to the part to be set, in particular to the rivet pin.

- 5 78. The method as claimed in claim 77, wherein a plurality of measured values are obtained at regular time intervals during the application of the tensile force.
- 10 79. The method as claimed in claim 77 or 78, wherein the measured values are obtained by means of a piezoelectric sensor.
- 15 80. The method as claimed in one of claims 77 to 79, wherein the at least one measured value is compared with a desired value.
- 20 81. The method as claimed in claim 80, a fault message being output on a display as a function of the deviation of the at least one measured value from a predefined desired value.
- 25 82. A head piece for a setting tool, in particular for a setting tool as claimed in claims 60-76, which comprises a device comprising at least one piezoelectric sensor for measuring the tension exerted by the pulling apparatus.
- 30 83. The head piece for a setting tool as claimed in claim 82, which comprises a device for measuring the position of the pulling apparatus.
84. The head piece for a setting tool as claimed in claim 82 or 83, wherein the device for measuring the tension exerted by the pulling apparatus comprises a pressure

sensor.

- 5 85. The head piece for a setting tool as claimed in claim 84, wherein the pressure sensor is a piezoelectric pressure sensor.
- 10 86. The head piece for a setting tool as claimed in one of claims 82 to 85, which comprises a device for registering and evaluating tension measured values.
- 15 87. The head piece for a setting tool as claimed in claim 86, wherein the device for registering and evaluating tension measured values comprises a counter which counts rivet setting cycles.
- 20 88. The head piece for a setting tool as claimed in claim 86 or 87, wherein the device for registering and evaluating tension measured values comprises a device for registering the date and/or time of day.
- 25 89. The head piece for a setting tool as claimed in one of claims 82 to 88, which comprises a device for transmitting tension measured data to an external unit.
- 30 90. The head piece for a setting tool as claimed in claim 89, the device for transmitting tension measured data comprising a device for transmitting infrared, ultrasound or radio signals.
91. The head piece for a setting tool as claimed in claim 89 or 90, the external unit comprising a computing unit.
92. The head piece for a setting tool as claimed in claim

89, 90 or 91, the external unit comprising a mobile radio terminal.

- 5 93. The head piece for a setting tool as claimed in one of claims 82 to 92, which further comprises a device for switching off the rivet setting implement in response to a signal generated in the event of a faulty rivet setting operation.
- 10 94. The head piece for a setting tool as claimed in claim 92 or 93, the signal being generated by an external unit.
- 15 95. The head piece for a setting tool as claimed in one of claims 82 to 94, which comprises a device for connection to a local network.
- 20 96. The head piece for a setting tool as claimed in one of claims 82 to 95, the pulling apparatus comprising a draw spindle and the device for gripping a rivet pin comprising clamping jaws for clamping a rivet pin.
- 25 97. A method for monitoring a rivet, in particular for a setting tool as claimed in claim 1 to 27, wherein a tension is applied to the rivet, the change in length of the rivet is measured and is compared with a desired value.
- 30 98. The method as claimed in claim 97, wherein the rivet is a blind rivet and the tension is applied to the rivet pin.
99. The method as claimed in claim 97 or 98, wherein rivets which do not lie within a predefined tolerance band are

separated out.

100. The method as claimed in claim 97, 98 or 99, wherein
rivets which lie within a predefined tolerance band are
5 marked permanently.

101. A rivet, monitored with a method as claimed in one of
claims 97 to 100.